faction of achievement will then reward the surgeon for his perseverance.

Another advantage of local anæsthesia is that it is entirely under the control of the operator. It is not always possible to have the services of a skilled anæsthetist, and an untrained assistant pouring chloroform and ether is, speaking mildly, a doubtful asset. In rural practice, in isolated communities, and in hospitals with depleted staffs, this advantage of local anæsthesia is of particular importance.

With our present knowledge it is neither possible nor advisable to dispense wholly with general anæsthetics. Such operations as internal version, manual rotation of the head, high forceps or manual removal of the placenta demand a general anæsthetic. Often a patient's needs are best met by a combination of general and local anæsthesia. A plea is made, however, for better understanding of the capabilities of local anæsthesia, a knowledge of the technique and for greater application of the method because of its greater safety.

SUMMARY

1. A majority of operations in obstetrics and gynæcology can be done under local anæsthesia.

2. Local anæsthesia is applicable in conditions which contraindicate general anæsthesia, *e.g.*, toxæmias, respiratory infections and heart disease with decompensation.

3. Because general anæsthetics may produce anoxia in the fetus, while local anæsthesia does not, the latter is safer for the fetus.

4. The technique for local anæsthesia in vaginal delivery and Cæsarean section is described.

5. A plea is made for greater use of local anæsthesia.

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PRECISION IN THE CARE OF THE OPERATIVE PATIENT*

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THE time upon the operating table has always been a dramatic hour, with the surgeon and the patient taking the leading rôles and the instrument nurse and anæsthetist granted more or less minor parts. The surgeon has always been the great artist with hands inherently formed for the task, and so guided as to effect the perfect incision and reconstruction. Delicacy and precision have always been stressed in the minds of those picturing him approaching, dissecting, and leaving unharmed, the most delicate and vital structures.

The anæsthetist has been pictured as an artist, too. Books have been titled "The Art of Anæsthesia", and often when the anæsthetist has provided particularly good working conditions the surgeon and visitors have praisefully remarked, "Well, that's the art of anæsthesia". This compliment is most gratifying to the individual anæsthetist. We in anæsthesiology tend to hug it to our hearts and guard it lest we may some day lose it. It seems to imply something different from the art and precision in surgery, something less precise and objective, something that cannot be clearly seen and demarcated, that cannot exactly be described and taught. It seems to imply a skill that comes of an inherent intuition, developed and conditioned by special experience, and delivered with a precision that is different from exactness, something that might even be lost with the individual as certain arts have been lost to mankind, at least for periods of time. It is forgivably gratifying to the anæsthetist to feel that he possesses such a personal skill.

Those of us who have taught anæsthesiology, like those who have taught all other subjects, have found it increasingly necessary to avoid generalities, to crystallize their own observations, to simplify and clarify the signs which guide them in the management of anæsthesia. The knowledge of underlying physiology and pharmacology has constantly become more pro-

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found and explicit, making more bits of evidence available to us and more understandable. Only by a fuller knowledge and application of these things can anæsthesia be truly artful, as well as more scientific.

Surgical patients come to us often quite out of physiological balance. If we are to expect to restore them to health by our surgical procedure we must restore their physiological balance. This must be done before surgery if the best recovery is to be obtained. Hypovitaminosis must be corrected. Hæmoglobin, blood cell volume, and blood protein must be brought to normal. Blood sugar, chloride, sodium, potassium and calcium must be adjusted. As an example of good work which has been done in many places along these lines, the methods of alimentary and parenteral feeding which have been developed by Richard Varco at University of Minnesota[1] are outstanding and have been known as the Varco diets. If, because of unusual urgency of the surgical condition, it is impossible to restore adequate balance before surgery, such measures must be instituted coincidentally and continued throughout convalescence until fulfilled.

During surgery, plasma, blood electrolytes and fluid must be restored as lost and with as much precision as it is possible to muster. At the University of Minnesota, in all but minor cases, Wangensteen[2] has all sponges weighed and used dry, then reweighed. This of course does not account for the blood soiling the drapes but the latter can be fairly well estimated. It is intended to keep the replacement at least 100 c.c. ahead of the loss, a small part of the replacement being with plasma according to the preoperative status of the hæmoglobin and cell volume. Changes in blood pressure and pulse are of course important in influencing replacement. Decrease in blood pressure, however, may be a late call for blood as the vascular tree may compensate for some time for considerable loss. Rising pulse rate is definitely a call for blood rather than plasma. Estimation of blood loss is still probably our most precise way of knowing the need for replacement. It is not, however, precise enough, nor have we a precise enough way of recognizing the onset of shock. Someone will help us by providing practical ways for frequently and quickly determining blood concentration and specific gravity so that we can vary the speed and type of fluid replacement accordingly. Postoperatively patients are weighed daily as a guide to the kind and amount of intravenous and alimentary solutions needed.

All of the above measures are of great concern to the anæsthetist. Certainly those applying to the period in the operating room are his immediate and particular responsibility whether he or someone else does the technique of starting and changing the flows.

As to the anæsthesia itself, procedures are becoming more and more precise. The use of the intratracheal tube is becoming more general in every anæsthetist's practice because a mask fits with less precision and allows for less sureness in the regulation or respiratory exchange and oxygen delivery. To make the tracheal tube still more precise, a large, very soft inflatable cuff surrounds the tube and is inflated with precision to a sufficient but safe air pressure indicated by a manometer at 15 cm. of water.[3]

An instrument is available on most anæsthesia machines which constantly indicates the pressure in the patient's lungs, in the respiratory tubing and bag. One can regulate this pressure both during the usual breathing and during inflation of the lungs by the anæsthetist.

Carbon dioxide is removed from the closed or semi-closed respiratory circuit with soda-lime, and in order to know with precision that the soda-lime is actually doing an efficient job a little of the gas to be inhaled is frequently bubbled through a tube of lime water to detect unremoved carbon dioxide.

Rebreathing of the warm gas, still further warmed by the reaction of the soda-lime with carbon dioxide, causes the patient's temperature to rise. The axillary temperature is read at frequent intervals and this is largely controlled by passing the gas through an ice-cooled canister.[4]

Oxygen concentration can be controlled with precision by taking advantage of the carbon dioxide absorption and rebreathing technique but allowing certain small, but constant, excess flows of both oxygen and gas to continue in fixed proportion. The excess overflows through the escape valve. The oxygen then remains constant but in lesser percentage than the flow meters indicate. One should become familiar with the percentage of oxygen actually derived from certain small proportional flows. This

can be arrived at by making a number of oxygen determinations with samples of gas from the inhalation tubing.

There is one outstanding lack of precision in anæsthesia which still cries for an adequate solution. The respiratory minute-volume is not always, but is usually, decreased below normal and this is certainly always true in the deeper anæsthesia required for abdominal relaxation. In proportion to this decrease the patient fails to eliminate carbon dioxide from his blood and the carbon dioxide tension rises. He does not respond to this with increased respiration because his respiratory controls are depressed by the anæsthesia. This upsets the blood pH, mobilizes bases and starts a train of events which interferes with uneventful convalescence. We never know the extent of carbon dioxide retention. We can and do generally obviate it by controlling the respiration through manipulation of the bag, but we can not know whether we are over- or under-ventilating. We greatly need a gadget which will sample the exhaled gas and determine its carbon dioxide tension within a minute. Accordingly we will be able to increase or decrease the respiratory exchange artificially, thus keeping the carbon dioxide tension in the exhaled gas, and so also in the blood, at the normal level. Not until we can accomplish this will we administer truly physiological anæsthesia and return the patient to his bed in the best possible condition.

I believe that a practical instrument for carbon dioxide and respiratory volume control is within reach.

If the respiratory exchange is made adequate to keep the blood carbon dioxide at the normal level, and if at the same time the oxygen in the inspired atmosphere is normal and blood pressure and blood replacement is kept up, one can rest assured that no tissue will suffer from oxygen deficit.

Is it too much to hope that we will some day be equipped for a running electrocardiogram on each anæsthetized patient? We know of an occasibnal death on the table which seems unexplainable. Will we not be justified in adding even this expense to the cost of anæsthesia in order to get possible warning and help for such an occasional patient? Is this too much to add to our standard of living, or prevention of dying?

All the measures of precision mentioned above involve a considerable effort and might be classified by some as nuisances and unwarranted expenses. Few of them are followed with anything like routine in many places. How much of such effort should we put in when the average patient does well without them? The remark may be made, that the skillful anæsthetist does not need such things, he can do as well with the "art of anæsthesia" and, in fact, some may say that such gadgets may be just an effort to turn anæsthesia over to technicians.

I believe that the more skillful and understanding the professional anæsthetist becomes the more he feels the need of more precision methods and the benefits to himself and to his patients to be derived from more precisely controlled physiology. Most advances in anæsthesiology will be along these lines.

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TULARÆMIA*

(With a Report of Nine Cases)

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TULARÆMIA holds a somewhat unique place among human maladies. The causative micro-organism was identified before the disease was recognized in man. Within the 34 years that have elapsed since the first description of the etiological agent we have been furnished with a fairly complete picture of the etiology, epidemiology, pathology and symptomatology of the disease. Further, within the past few months a therapeutic agent has been used which promises to be an effective method of treatment.

Tularæmia gets its name from the fact that the causative micro-organism, *Bacterium tularense*, was discovered by McCoy and Chapin[1] in 1912 as the agent which produced a plague-like disease of ground squirrels in Tulare County, California. The micro-organism was first isolated from man by Wherry and Lamb[2]

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